KUNDLER CONTROLLERS

Adaptor Board for

Step Motor Controller

TURBO-STEP 45 PCI

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1. Components and Dimensions

The adaptor board consists of a printed circuit board, mounted on an aluminum plate or an angled support, and two sub-d cables, 15 pins and 25 pins with a length of 1 through 5 m.
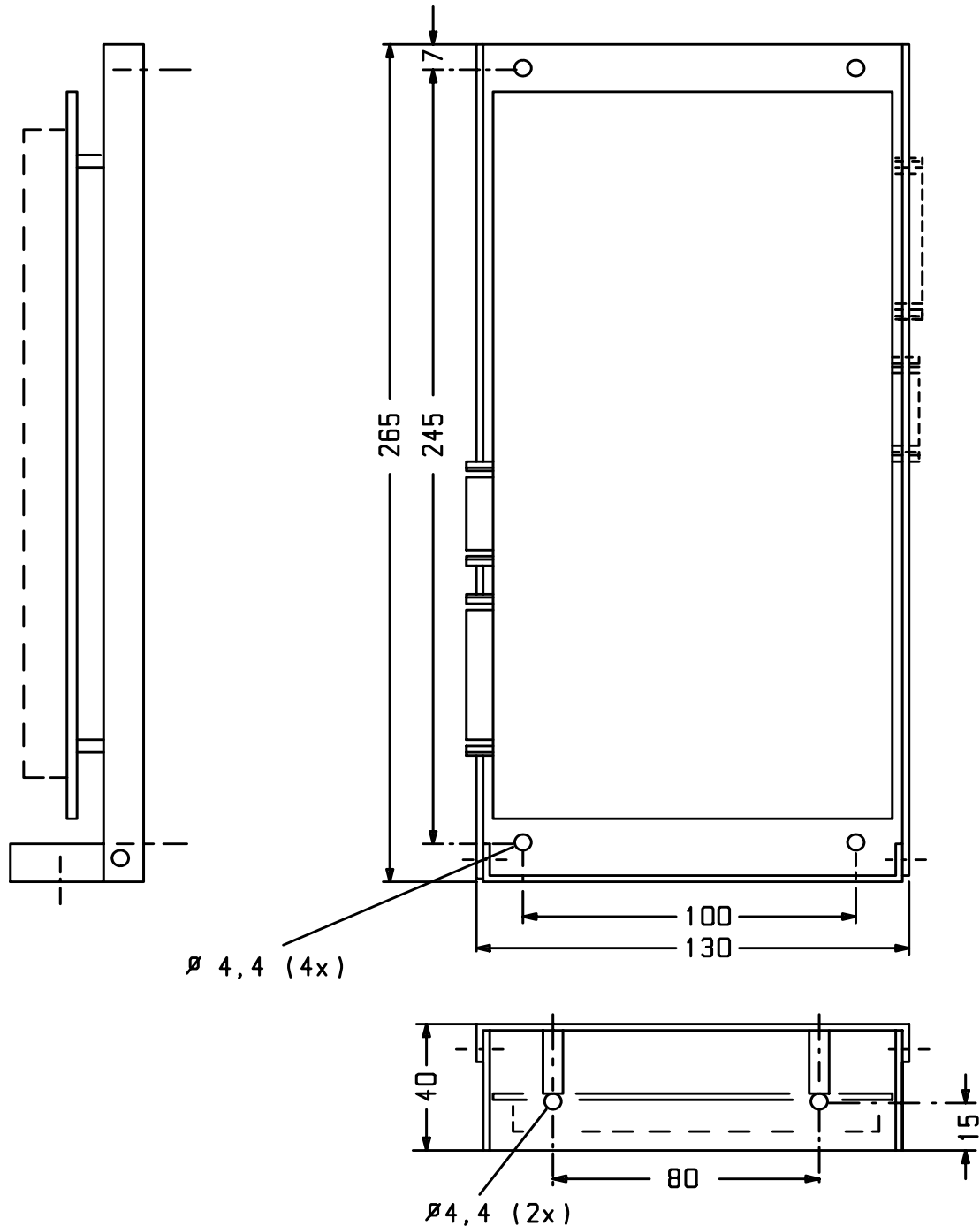
Dimensions

Mounted on an Aluminum Plate:
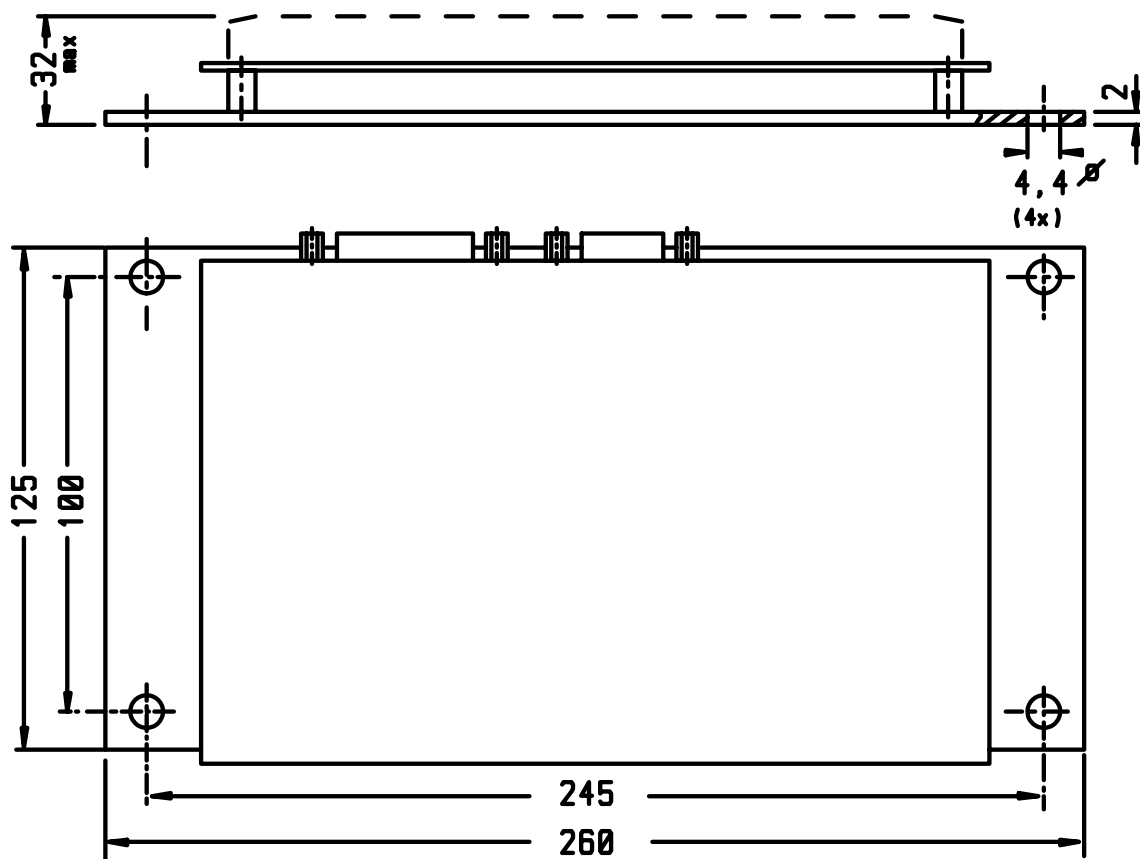
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Mounted on an Angled Support:

The circuit board may be turned by 180 degs. and mounted on the support.

2. Cabling

The adapter is connected to the controller with 2 sub-d cables with 15 and 25 pins. The step and direction signals for the motor amplifiers are transmitted through the 15 pins cable, the input and output signals to the other peripheral devices are transmitted through the 25 pins cable.

3. Connection to Amplifiers and Peripheral Devices

Amplifiers and peripheral devices are connected to the following terminals at the adapter board:

- Terminal strips for 8 step motor amplifiers
- Terminals for 2 limit actuators each for max. 4 axis
- Reference input terminals 'coarse' and 'fine' for the axis X, Y and Z
- 4 free input ports C1 through C4 (C3 and C4 may be used as limit inputs of the axis U)
- 1 emergency stop input terminal
- 1 analogue output (type TURBO-Step 45 PCI-1 only)

When operating more than 4 axis, 2 axis groups must be created. The limit inputs must be assigned to both groups.

Inputs and outputs are isolated from the voltages within the PC, except for the analogue output. Also, the inputs and the outputs are isolated from each other.

3.1 Connection to the Step Motor Amplifiers

The properties of the inputs of the step motor amplifiers are important to decide, which one of the connection options is to be used. Several options are available. Carefully select the correct one described in this chapter.

Also refer to the schematic drawing 30134.04-STR-C.

When using RS422 line drivers, twisted pairs and appropriate load resistors are required at the ends of the lines or at the inputs of the line receivers within the amplifiers. This is necessary to prevent signal distortion and eventually erroneous steps. Please refer to the respective amplifier description.

3.2 Grounding the Adaptor

The adaptor is already connected to ground by the shields of both SUB-D cables, which are grounded at the computer. However, it is mandatory to connect at least one of the grounding screws additionally to ground with a short line.

The connections to the motor amplifiers must be shielded. Twisted pairs are required if RS422 line drivers are used. The shield should be grounded on both ends of the cable. It should be soldered to the sheet cover of the plug when using SUB-D plugs.

3.3 Amplifier Inputs with Opto-Couplers with a Voltage Level of 5 Volts

These amplifier inputs are very common. The input circuit is a serial connection of a light emitting diode and a resistor with approximately 330 Ohms.
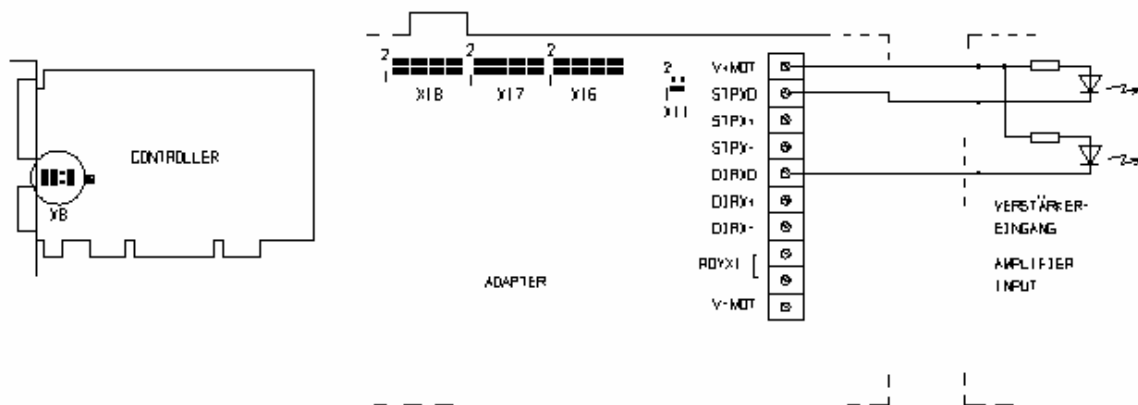
The step and direction signals at the terminals STPX1D and DIRXD, respectively, are connected to the cathode sides of the opto-coupler's light emitter diodes.

Use the direct outputs of the step and direction signals on the controller board, and select the low going edge of the step pulse to execute each step. For this selection the jumpers below the cover of the adaptor remain unchanged as factory default setting. However, the jumpers on the controller board must be set according to the following table (shown in the above figure):

Controller	Adaptor
X8: 1-2, 3-4,7-8	**X16 :** 1-3, 2-4, 5-7, 6-8, 9-11, 10-12,13-15, 14-16 **X17:** same setting as X16 **X18:** same setting as X16 **X11:** 1-3 or remove all

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A low side switch initiates each step pulse by switching the opto-coupler current to the voltage reference V-MOT.

Select the logical sense "active low" for the step pulses by means of the instruction TSLEV (or within PCT25: G10) within the initialization phase of your program.

3.4 Amplifier Inputs with Opto-Couplers with a Voltage Level of 12 Volts

The circuit of this amplifier inputs consists of a series connection of a light emitting diode and a resistor of approximately 1 kOhm.

An external voltage source with 12 Volts is neccessary. It must not be stabilized. A DC voltage, smoothed with an electrolytic capacitor is sufficient.

The step and direction signals at the terminals STPX1D and DIRXD, respectively, are connected to the cathode sides of the opto-coupler's light emitter diodes.
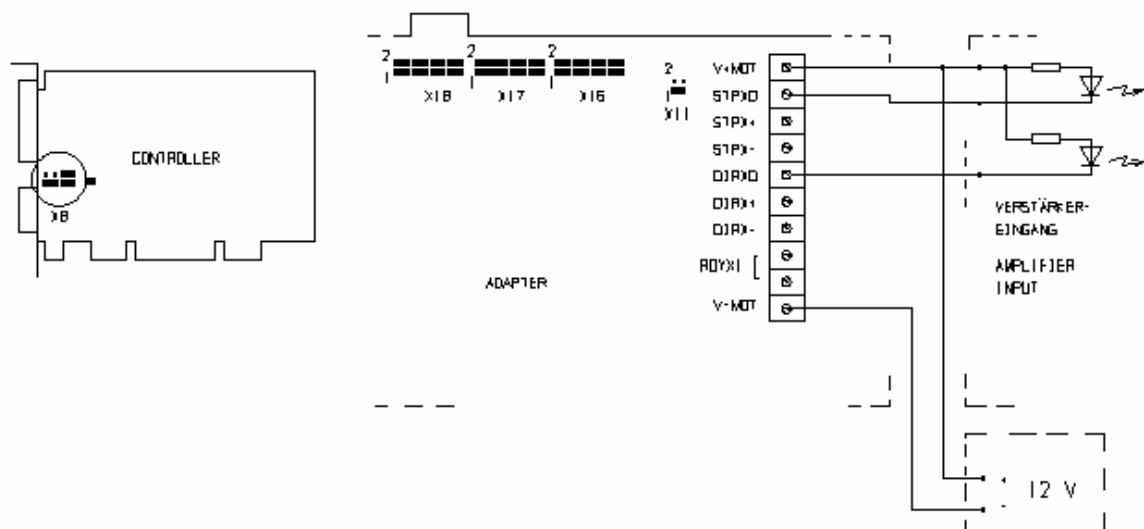
Use isolated outputs for the step and direction outputs on the controller board, and select the low going edge of the step pulse to execute each step. For this selection the jumpers below the cover of the adaptor remain unchanged as factory default setting. The same applies for the jumper setting on the controller board.

The settings are shown in the following table:

Controller	Adaptor
X8: 1-3, 5-7, 6-8	**X16 :** 1-3, 2-4, 5-7, 6-8, 9-11, 10-12,13-15, 14-16
	X17: same setting as X16
	X18: same setting as X16
	X11: 1-3 or remove all

Connect the external voltage source to the terminal strip X3 as follows:

V+MOT: Plus
V-MOT: Minus

A low side switch initiates each step pulse by switching the opto-coupler current to the voltage reference V-MOT.

Select the logical sense "active low" of the step pulses by means of the instruction TSLEV (or within PCT25: G10) within the initialization phase of your program.

3.5 Amplifier Inputs with RS422 Line Receivers with grounded Voltage Reference

RS422 receivers require a pair of twisted wires for each step and direction signal. The voltage level on each line is 0 to 5 volts, while the signals on both lines go into opposite directions.
This refers only to amplifiers with grounded zero voltage. Also the PC's zero voltage is grounded.
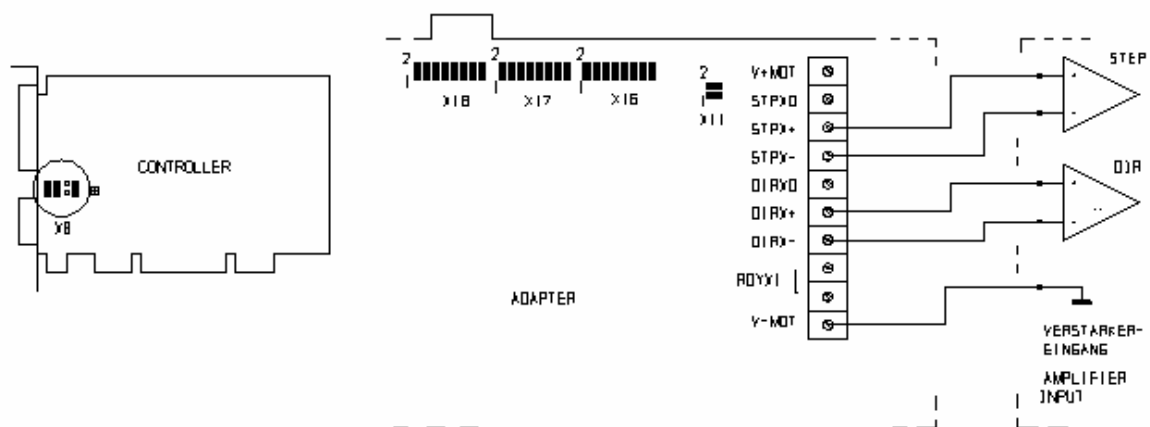
Use direct coupling for the step and direction outputs. Adapt the active edge of the step pulse (active high or active low) to the specification of the respective amplifier.

Ensure that this specification will really be observed. In case you use 2 axis groups, it is important that the low going edge of the step pulse within the controller initiates the step in order to ensure, that no unintended step will be caused when changing the axis group. If this condition does not fit to the prescribed sense of pulses at the amplifier input, simply exchange the lines STPX+ with STPX-. The same applies for every axis. For this connection mode the jumper setting must be modified according to this table and the previous figure.

Controller	Adaptor
X8: 1-2, 3-4, 7-8	**X16 :** 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16 **X17:** same setting as X16 **X18:** same setting as X16 **X11:** 1-3, 2-4

3.6 Amplifier Inputs with RS422 Line Receivers with 5 Volts Supply Isolated from the PC

RS422 receivers require a pair of twisted wires for each step and direction signal. The voltage level on each line is 0 to 5 volts, while the signals on both lines go into opposite directions.

This connection mode refers to such an amplifier with RS422 inputs, the zero reference of which is not or must not be tied to ground, and which has a +5 volts output to supply the RS422 line drivers within the adaptor.

Use isolated outputs of step and direction signals on the controller board. Adapt the active edge of the step pulse (active high or active low) to the specification of the
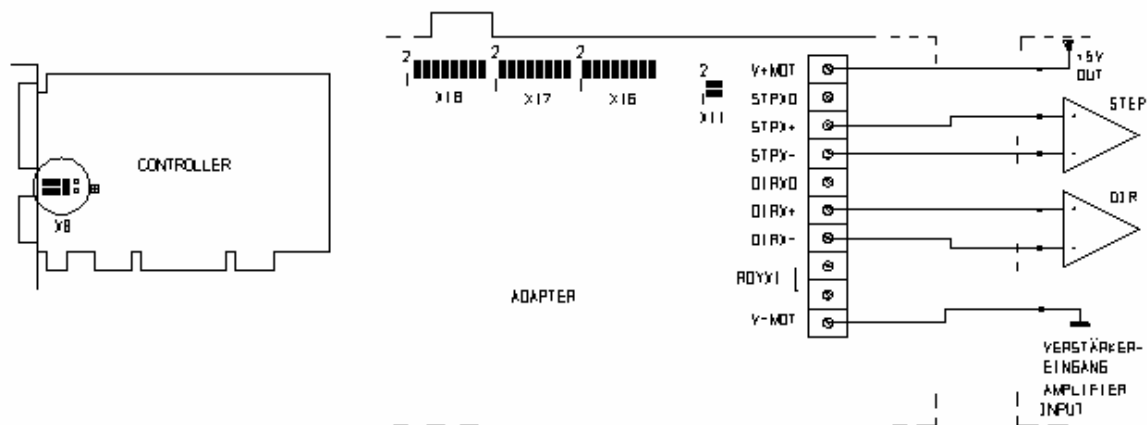
respective amplifier. Ensure that this specification will really be observed. In case you use 2 axis groups, it is important that the low going edge of the step pulse within the controller initiates the step in order to ensure, that no unintended step will be caused when changing the axis group. If this condition does not fit to the prescribed sense of pulses at the amplifier input, simply exchange the lines STPX+ with STPX-. The same applies for every axis. For this connection mode the jumper setting must be modified according to this table and the previous figure:

Controller	Adaptor
X8: 1-3, 2-4, 5-6	**X16 :** 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16 **X17:** same setting as X16 **X18:** same setting as X16 **X11:** 1-3, 2-4

3.7 Amplifier Inputs with RS422 Line Receivers with +8 through +12 Volts Supply Isolated from the PC

RS422 receivers require a pair of twisted wires for each step and direction signal. The voltage level on each line is 0 to 5 volts, while the signals on both lines go into opposite directions.

This connection mode refers to such an amplifier with RS422 inputs, the zero reference of which is not or must not be tied to ground, whereby an external voltage source supplying +8 through +12 volts dc.

Use isolated outputs of step and direction signals on the controller board. Adapt the active edge of the step pulse (active high or active lo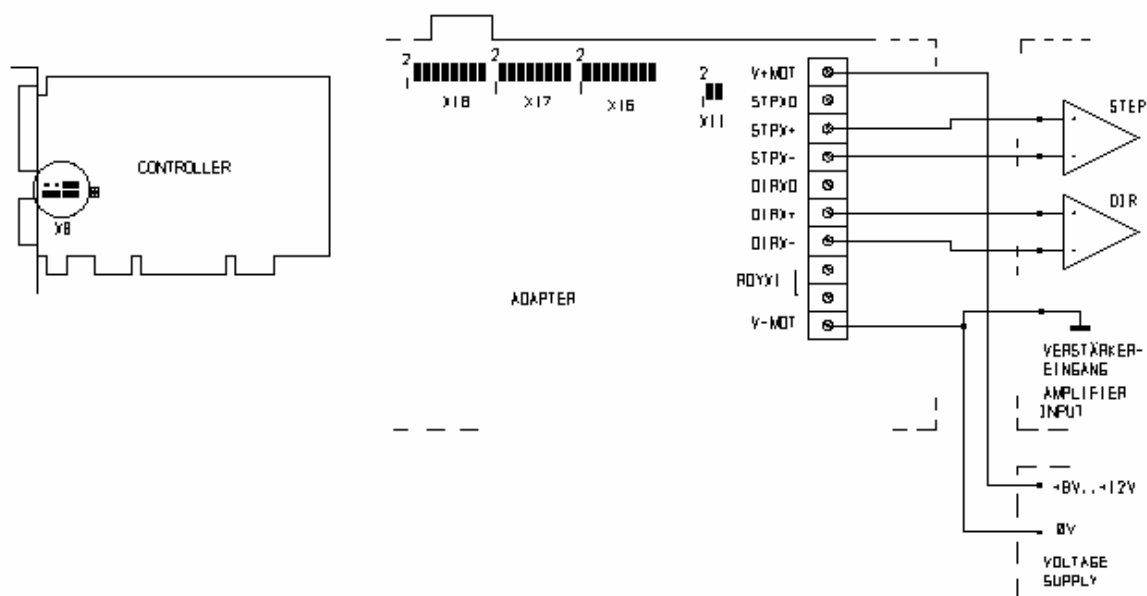w) to the specification of the respective amplifier. Ensure that this specification will really be observed. In case you use 2 axis groups, it is important that the low going edge of the step pulse within the controller initiates the step in order to ensure, that no unintended step will be caused when changing the axis group. If this condition does not fit to the prescribed sense of pulses at the amplifier input, simply exchange the lines STPX+ with STPX-. The same applies for every axis. For this connection mode the jumper setting must be modified according to this table and the previous figure:

Controller	Adaptor
X8: 1-3, 5-7, 6-8	**X16 :** 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16 **X17:** same setting as X16 **X18:** same setting as X16 **X11:** 1-2, 3-4

4. Connection to External Actuators and Loads

External actuators may supply positive voltages of 5 through 24 volts referred to the terminal GND_INPUTS. The input resistance is 2,2 kOhms. The input current returns through the terminal GND_INPUTS.

For detailed information about the circuits of the inputs and outputs please refer to the user manual of the controller.

External loads such as solenoids, lamps, relays etc. require an external voltage source of 24 volts dc, which must be connected to the terminals V+_OUTPUTS and GND_OUTPUTS with its positive and negative terminal, respectively. The supply voltage must not be stabilized, however a smoothing electrolytic capacitor is necessary.

The outputs OUT_V1 through OUT_V4 switch the respective load to zero by „low side switches". When the respective output is activated, it will connect the external load to GND_OUTPUTS.

Caution: prevent any short circuit between the external supply voltage +24 volts (connected to V+OUTPUTS) and anyone of the terminals OUT_V1 through OUT_V4.

Such short circuit will damage the respective power CMOS switch on the controller.

The potentials GND_INPUTS and GND_OUTPUTS are not tied together. The user may connect these potentials externally, however.

The power CMOS switches are protected agains inductive surge by diodes.

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When driving external loads, please observe the recommendations for noise immunity following below.

5. Connection to READY Contacts within Motor Amplifiers

Many amplifiers contain make/break contacts indicating if the corresponding drive is ready to operate. Such contact signal can be detected by the control program. For each axis exists a pair of terminals "RDY.+" and "RDY.-", which are all serially connected. If each pair is connected to the respective contacts, the serialized contact signal will indicate wether all amplifiers are ready or one of them fails. Replace any missing contacts with a bridge wire. Select the controller input which is to be used by placing the appropriate jumper on the jumper field X12. Please refer to the schematic at the end of this manual.

6. Installation and Starting Operation

Important note:

Switch off the computer prior to connecting the adaptor to the controller or changing the jumper setting.

Adjust the jumpers on the jumper field X8 of the controller according to the controller manual or to the above instructions.

Select symmetrical or unsymmetrical signal shape of step/direction outputs according to the above instructions.

Refer to the circuit diagram 30134.04-STR-C.

Connect both sub-d cables to the controller installed in the computer.

6.1 Ensure Noise Immunity in Operation

Inductive peak voltages will be shorted within the adaptor, however, this is often not sufficient to suppress burst disturbances. Ensure safe operation by these additional measures:

Suppress the voltage peaks, caused when the current through an inductive load (solenoid, relay etc.) is switched off, by connecting an extra diode directly at the inductive load with short leads.

This prevents the surge pulses from causing noise interferences before they will be absorbed within the adaptor.

Compensate for brush noise of a dc motor by connecting a capacitor directly at the motor terminals.

Brush sparks will cause high frequent noise on the leads, which can also increase within the life time of the equipment.

One of the ground screws on the adaptor should be tied to a ground screw of the PC and to the rack or case supporting the control components. Use short protection ground wires with at least 2,5 qmm (0,0039 sq.inch).

This ensures the stability of the ground potential within the adaptor even when the protection ground within the PC plug should be unstable. As the zero reference of the 5V supply inside each PC is tied to the case, the recommended connections contribute to ensure noise and disturbance immunity.

Submit to technical changes without notice.

7. Circuit diagram

(see next page)

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